

A REVISION OF THE NORTH AMERICAN SPECIES OF HELIANTHEMUM (CISTACEAE)

(CONTINUED FROM P. 82)

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SYSTEMATIC TREATMENT*

- HELIANTHEMUM [Tourn.] Mill., Gard. Dict. Abr. ed. 4. 1754.
Cistus L., Sp. Pl. 523-529. 1753 & Gen. Pl. 234. 1754. (in part).
Helianthemum sect. *Lecheoides* Dunal, DC. Prodr. 1: 269. 1824.
Crocanthemum Spach, Ann. Sci. Nat. 2nd ser. 6: 370. 1836. Lectotype:
C. carolinianum (Walt.) Spach = *H. carolinianum* (Walt.)
Michx.
Heteromeris Spach, Ann. Sci. Nat. 2nd ser. 6: 370. 1836. Lectotype:
H. canadensis (L.) Spach = *Helianthemum canadense* (L.)
Michx.
Taeniostema Spach, Ann. Sci. Nat. 2nd ser. 6: 371. 1836. Type: *T.*
micranthum Spach = *H. glomeratum* (Lag.) Dun.
Anthelis subg. *Horanthes* Raf., New Fl. N. Am. 3: 30. 1836 [1838].
Horanthes (Raf.) Raf., Sylva Tell. 132. 1838.
Helianthemum subg. *Lecheoides* (Dunal) Reiche, Nat. Pflanzenfam.
III. 6: 306. 1895.
Halimium sect. *Spartioides* Gross., Pflanzenreich 14 (IV. 193): 33.
1903.
Halimium sect. *Lecheoides* (Dunal) Gross., Pflanzenreich 14 (IV.
193): 33. 1903.
Crocanthemum sect. *Spartioides* (Gross.) Janchen, Nat. Pflanzenfam.
ed. 2. 21: 305. 1925.
Crocanthemum sect. *Lecheoides* (Dunal) Janchen, Nat. Pflanzenfam.
ed. 2. 21: 305. 1925.

Generic Description

Perennial herbs or small shrubs. STEMS one to many, decumbent to erect, arising from a woody caudex or rarely from an elongate, subterranean, woody rootstock. BASAL LEAVES, when present, either in a rosette or forming a mat. CAULINE LEAVES alternate, estipulate (an axillary tuft of leaves characteristic of several species sometimes mistaken for stipules), sessile to short-petioled, gradually reduced in size above; the blade entire or rarely subdentate with a conspicuous midvein and with the pinnate secondary veins varying from very obscure to prominently elevated beneath. PUBESCENCE typically present and usually abundant; trichomes predominantly stellate but

*The generic description and synonyms presented here are specifically intended to apply only to the North American species of *Helianthemum*.

occasionally intermixed with simple or glandular hairs. INFLORESCENCE: cymose, paniculate, or thyrsoïd. FLOWERS either chasmogamous (petals 5; stamens 10 or more, anthers (1-) 1.5-2 times longer than wide and dehiscing laterally by means of longitudinal slits) or cleistogamous (petals lacking; stamens up to 8, anthers short and about as long as wide and dehiscing by means of rupture in the wall adherent to the stigma). Flowers either isomorphic (chasmogamous or cleistogamous) or dimorphic (both chasmogamous and cleistogamous). When dimorphic, either occurring together in the same cluster, or separately. Bracts linear, lanceolate, or somewhat spatulate.

CHASMOGAMOUS FLOWERS: SEPALS 5, the two outer ones linear, spatulate or lanceolate, mostly shorter than the ovate inner sepals. PETALS 5, yellow, fugacious. STAMENS 10-50, filaments slender, mostly exceeding the pistil in length; anthers oblong to linear, mostly (1-) 1.5-2 times longer than wide and dehiscing laterally by means of longitudinal slits, neither cohering with one another nor adhering to the stigma at anthesis. OVARY ovoid, one-celled, glabrous or stellate-pubescent (in 2 species); style straight and erect, varying from almost wanting to 1 mm. in length (always shorter than the ovary); stigma capitate. CAPSULE loculicidally dehiscent, ovoid, ellipsoid, or ovoid-triquetrous, shorter than calyx, glabrous or stellate-pubescent on the upper half, unilocular, usually 3-valved (one species characteristically 2-valved). SEEDS 1-45(-135), mostly irregular, ovoid, somewhat flattened or rarely globose, smooth, reticulate, or papillate; the smooth seeds and the ones covered with white papillae having a thin separable membrane when moistened, (and then the embryo becoming somewhat visible), while the outer testa of the reticulate or dark papillate seeds not readily separable when wetted.

CLEISTOGAMOUS FLOWERS: SEPALS 5, the two outer ones linear, spatulate, or rudimentary and knob-like and then attached near the middle edge of the ovate inner sepals. PETALS lacking. STAMENS (3-) 4-6(-8), filaments slender, equaling the pistil in length; anthers short and about as long as wide, mostly coherent, dehiscing by means of a rupture of the wall adherent to the stigma and often remaining attached to the stigma even in fruit. OVARY similar to that of the chasmogamous flower but smaller; its style shorter. CAPSULE ovoid to mostly ovoid-triquetrous, other characters similar to those of the chasmogamous capsule. SEEDS smaller and fewer (1-22) but otherwise resembling those of the chasmogamous fruit.

KEY TO THE NORTH AMERICAN SPECIES OF HELIANTHEMUM

1. Ovary and capsule densely stellate-pubescent at least in the upper third.
2. Capsule 3-valved; plants mostly 20 cm. tall or less; inflorescence terminal and umbellate; inner sepals of largest flowers mostly

- 4-8 mm. long and in fruit over 5.5 mm. long; seeds mostly more numerous than 10/capsule; nw. Fla. to Miss. 5. *H. arenicola*.
2. Capsule 2-valved; plants mostly 20 cm. tall or more; inflorescence a terminal and/or lateral, cylindrical, leafy thyrse; inner sepals of the largest flowers mostly 3.5-5.0 mm. long and in fruit not longer than 5.5 mm. long; seeds mostly less numerous than 10/capsule; peninsular Fla. 6. *H. Nashii*.
1. Ovary and capsule glabrous throughout.
3. Pedicels and branches of the inflorescence densely beset with coarse dark red trichomes 0.3-0.6 mm. long terminated by a small glandular knob; Channel Islands of s. Calif. 9. *H. Greenei*.
3. Pedicels and branches lacking glandular trichomes.
4. Leaves spatulate, less than 1 cm. long, broadest well above the middle; margins with ciliate trichomes half to as long as the width of the leaf; low woody shrub; Baja Calif. .. 11. *H. nutans*.
4. Leaves various but not all spatulate and often exceeding 1 cm. in length, usually broadest at the middle or towards the base; leaf-margins eciliate or if trichomes present these never equaling in length half the width of the blade; herbaceous to shrubby.
5. Median cauline leaves 2 mm. wide or less and less than 1 cm. long; Mexico or Calif.
6. Flowers isomorphic, all petaliferous; pedicels 2-12 mm. long; foliage typically densely stellate-pubescent but varying to glabrate or rarely even glabrous; seeds 4-20/capsule; Calif., Baja Calif. and central Mexico.
7. Median cauline leaves more than 8 times as long as broad; inner sepals up to 7 mm. long; outer sepals up to 4.5 mm. long; Calif. and n. Baja Calif. 10. *H. scoparium*.
7. Median cauline leaves less than 8 times as long as broad; inner sepals not exceeding 4 mm. long; outer sepals 2.5 mm. or less in length; central Mexico. 12. *H. patens*.
6. Flowers dimorphic, petaliferous and apetalous; pedicels of the apetalous flowers 1 mm. long or less; foliage finely but exceedingly densely pubescent (and the pubescence not apparently stellate); seeds 3 or fewer/capsule; central Mexico 20. *H. argenteum*.
5. Median cauline leaves 2 mm. or more in width and mostly over 1 cm. long.
8. Lower surface of leaf-blade with both prominently elevated secondary veins and a visible epidermis (i.e. the pubescence sparse enough so that the epidermis is not completely obscured.)
9. Herbs up to 4 dm. high with persisting basal leaves; flowers 6 or fewer borne in a loose scorpioid cyme but

- appearing solitary; outer sepals lanceolate, mostly more than 0.5 mm. wide (and often up to 1.5 mm.); seeds 50 or more/capsule and lacking a separable membrane when moistened; se. Coastal Plain of the U.S.
 1. *H. carolinianum*.
9. Shrubs up to 10 dm. high and lacking basal leaves; flowers in dense corymbose clusters terminating branches; outer sepals linear, less than 0.5 mm. wide; seeds 10 or fewer/capsule and possessing a readily separable membrane when moistened; central and w. Mexico.
 14. *H. concolor*.
8. Lower surface of leaf-blade either lacking prominently elevated veins and/or the pubescence so dense that the lower epidermis is completely obscured.
10. Lower half of stem densely beset with simple, villous trichomes as well as stellate pubescence; Mexico and Central America.
11. Secondary venation conspicuously elevated beneath; seeds lacking a hygroscopic membrane when wetted.
 4. *H. Coulteri*.
11. Secondary venation obscure or at least not conspicuously elevated beneath; seeds with a readily separable, hygroscopic membrane when wetted.
12. Inner sepals merely stellate-pubescent and never with villous trichomes; chasmogamous and cleistogamous flowers borne together at the end of the branches 16. *H. Pringlei*.
12. Inner sepals stellate-pubescent and also bearing villous trichomes; chasmogamous and cleistogamous flowers borne separately (the chasmogamous terminating the main stem and major branches and the cleistogamous borne in 1-to few-flowered, often glomerate clusters on short axillary branches).
 17. *H. chihuahuense*.
10. Lower half of stem merely stellate-pubescent to glabrate and never partly villous.
13. Cleistogamous flowers congested in a dense, terminal, corymbiform cyme and chasmogamous flowers, if present, long-pedicellate and overtopping the cluster; outer sepals and closely associated bracts narrowly spatulate and obtusely tipped; Coastal Plain of the se. U.S. (N.C. to Miss.) 13. *H. corymbosum*.
13. Cleistogamous flowers not borne in a dense, terminal, corymbiform cyme (although often in dense glomerules) and chasmogamous flowers, if present, not overtopping such an inflorescence, outer sepals and the

closely associated bracts linear and neither spatulate nor obtusely tipped.

14. Cleistogamous flowers (or fruit) lacking and secondary veins of leaf-blade not elevated beneath; Calif. and/or Mexico.

15. Leaves mostly 8-24 times as long as wide, their margins often revolute, often exceeding 1.5 cm. long; plants usually exceeding 2 dm. tall; Calif. and n. Baja Calif.
..... 10. *H. scoparium*.

15. Leaves mostly less than 8 times as long as wide, their margins not revolute, usually less than 1 cm. long and not known to exceed 1.5 cm. long; plants mostly less than 2 dm. tall and not exceeding 3 dm.; central Mexico
..... 12. *H. patens*.

14. Cleistogamous flowers (or fruit) present and/or secondary veins of leaf-blade noticeably elevated beneath.

16. Secondary veins of leaf not noticeably elevated beneath; seeds encompassed by a thin membrane that is readily separable when wetted; se. Coastal Plain of the U.S. or Mexico.

17. External sepals of the cleistogamous flowers less than 1.2 mm. long; internal cleistogamous sepals less than 2 mm. long; leaf-margin usually somewhat revolute; Coastal Plain from N.C. to e. Tex., also known from central Hispaniola. 19. *H. rosmarinifolium*.

17. External sepals of the cleistogamous flowers 1.2 mm. long or longer; internal cleistogamous sepals exceeding 2 mm. long; leaf-margin non-revolute; Central America, Mexico, or extreme s. Tex.

18. Inflorescence a loosely racemose cyme of 2-5 ± chasmogamous and cleistogamous flowers borne on elongate branches from the upper quarter of the plant; pedicels inconspicuously jointed, articulate; plants typically herbaceous and color not ashy.
..... 16. *H. Pringlei*.

18. Inflorescence in dense axillary and terminal glomerules with the chasmogamous flowers (when present) on elongate pedicels conspicuously overtopping the cleistogamous clusters; pedicels not jointed; plants suffru-

- ticose and of an ashy color.
 18. *H. glomeratum*.
16. Secondary veins of leaf noticeably elevated beneath; seeds either membranous or enveloped by a readily separable thin membrane when wetted.
19. Only chasmogamous flowers and/or fruit present on specimen.
20. Chasmogamous flowers solitary and terminating the stem but later overtopped by lateral branches (or if, when immature, 2 flowers appear together, the upper surface of the upper leaves with apparently simple trichomes intermixed with the stellate pubescence); e. U.S. and Canada.
21. Stems (0.5-)1.0-2.0(-3.0) dm. high with widely divergent branches and branchlets; pubescence of the upper surface of the midcauline leaves dense with the stellate pubescence so closely placed that the trichome-branches overlap; the upper epidermis hence obscured from view; Mass. to Long Island, N.Y. 2. *H. dumosum*.
21. Stems (0.8-)1.5-4.5(-6.5) dm. high with strongly ascending branches and branchlets; pubescence of the upper surface of the midcauline leaves relatively sparse with the stellate pubescence spaced so that the trichome branches rarely overlap, the upper epidermis hence readily visible; s. Canada to Ga. and w. to Mo. and Minn. 3. *H. canadense*.
20. Chasmogamous flowers clustered in groups of 2 or more.
22. Mature seeds with a separable membrane when wetted; calyces with only uniform short stellate puberulence; Coastal Plain from e. N.C. to n. Fla. and w. into Ark., s. Okla. and e. Tex.
 15. *H. georgianum*.
22. Mature seeds lacking a readily separable membrane after wetting; calyces often with elongate trichomes in addition to the short stellate puberulence; central and e. U.S. and s. Canada (Me. to n. Ga.

- w. to the Dakotas and Col.) or from Mexico and/or Central America.
23. Midcauline leaves mostly less than 3.5 times as long as wide, leaves often broadly elliptic to somewhat obovate; Mexico and Central America
..... 4. *H. Coulteri*.
23. Midcauline leaves mostly more than 3.5 times as long as wide, leaves usually oblanceolate to narrowly elliptic; central and e. U.S. and s. Canada.
24. Chasmogamous outer sepals fused with the inner sepals only near the base and the free portion more than half the length of the inner sepals, the free portion over 3.2 mm. long; stems arising from a multicapital caudex 7. *H. Bicknellii*.
24. Chasmogamous outer sepals fused for half to two-thirds the length of the inner sepals, the free portion less than 3.2 mm. long; stems arising from a horizontal rootstock
..... 8. *H. propinquum*.
19. Cleistogamous flowers and/or fruits present on specimen (the chasmogamous may also be present).
25. Chasmogamous flowers, when present, borne on filiform pedicels greatly overtopping the nearly sessile, glomerate, cleistogamous flowers; seeds with a separable membrane when wetted.
26. Internal sepals of the cleistogamous or fruit averaging less than 1.8 mm. long; cleistogamous capsules rounded in cross-section; median cauline leaves mostly 6 times or more as long as wide; Santo Domingo and the Coastal Plain from N.C. to n. Fla. and w. to e. Tex. and Okla. 19. *H. rosmarinifolium*.
26. Internal sepals of the cleistogamous flowers or fruit averaging over 2.2 mm. long; cleistogamous capsules 3-angled in cross-section; median cauline leaves less than 6 times as long as wide; extreme sw.

- Tex., Mexico, and Guatemala.
18. *H. glomeratum*.
25. Chasmogamous flowers lacking or, if present, not borne on filiform pedicels overtopping the subsessile, glomerate, cleistogamous flowers; seeds lacking a separable membrane when wetted or with such a membrane only in *H. georgianum*, *H. glomeratum* and *H. rosmarinifolium*.
27. Inner sepals of the cleistogamous flowers or fruits averaging less than 1.8 mm. long; the Coastal Plain from N.C. s. to n. Fla. and w. into e. Tex. and Okla. and also in the Dominican Republic
 19. *H. rosmarinifolium*.
27. Inner sepals of the cleistogamous flowers or fruits averaging more than 1.8 mm. long.
28. Mature seeds present on specimen.
29. Seeds with a hygroscopic, separable membrane when wetted.
30. Cleistogamous flowers (and chasmogamous also, if present) loosely arranged and each separately borne on the ends of branchlets; seeds per cleistogamous capsule 12 or more; capsules globose to ovoid; coastal N.C. to n. Fla. and w. to e. Tex.
 15. *H. georgianum*.
30. Cleistogamous flowers in dense axillary and terminal glomerules (the chasmogamous, if present, overtopping the compact, cleistogamous clusters); seeds/cleistogamous capsule fewer than 12 and mostly 2-7; capsules triquetrous; the Big Bend area of Tex. s. throughout much of Mexico and Guatemala 18. *H. glomeratum*.
29. Seeds lacking a hygroscopic, separable membrane when wetted.
31. External sepals of the cleistogamous flowers averaging over 1.2 mm. long; Mexico and Central America 4. *H. Coulteri*.

31. External sepals averaging less than 1.2 mm. long; U.S. e. of the Rocky Mts. and Canada.

32. Seed per cleistogamous capsule more numerous than 4, seed-surface papillate.

33. Stems (0.5-)1.0-2.0(-3.0) dm. high with widely divergent branches and branchlets; pubescence of the upper surface of the midcauline leaves dense with the stellate pubescence so closely placed that the trichome-branches overlap obscuring the epidermis from view; mature cleistogamous capsules and their associated calyces solitary or rarely two together at the tips of the branchlets; external sepals 0.4-1.2 mm. long; Mass. s. to Long Island, N.Y. .. 2. *H. dumosum*.

33. Stems (0.8-)1.5-4.5(-6.5) dm. high with strongly ascending branches and branchlets; pubescence of the upper surface of the midcauline leaves often relatively sparse with the stellate pubescence so spaced that the trichome branches rarely overlap and hence the upper epidermis readily visible; mature cleistogamous capsules and their associated calyces one to few and glomerate, terminating the short axillary branchlets; external sepals 0.2-0.4 (-0.6) mm. long; s. Canada to Ga. and w. to Mo. and Minn.
..... 3. *H. canadense*.

32. Seeds per cleistogamous capsule 1-3, seed-surface reticulate.

34. Stems usually clustered and upright, arising from an erect caudex; free portion of the

- outer sepals of the cleistogamous flowers linear, (0.3-)0.6-1.2(-1.8) mm. long, about 3-5 times longer than wide; cleistogamous capsule sharply 3-angled in cross-section
 7. *H. Bicknellii*.
34. Stems scattered, arising from a horizontal, elongate rootstock; free portion of the cleistogamous outer sepals rudimentary and knob-like, 0.2-0.5 mm. long, 1-2 times longer than wide; cleistogamous capsules somewhat rounded in cross-section
 8. *H. propinquum*.
28. Mature seeds lacking on specimen.
35. Pedicels of cleistogamous flowers over 0.5 mm. long; flowers loosely arranged at the ends of the branches or at least not in few- to many-flowered glomerules.
36. Outer sepals of the cleistogamous flowers 0.3-0.7 mm. wide; Mexico and Central America
 4. *H. Coulteri*.
36. Outer sepals of the cleistogamous flowers about 0.3 mm. wide; Coastal Plain from N.C. to n. Fla. and w. into e. Tex. .. 15. *H. georgianum*.
35. Pedicels of the cleistogamous flowers less than 0.5 mm. long, sessile or nearly so; flowers often borne in axillary clusters of 2 to many.
37. Leaves usually canescent and equally pubescent on both surfaces and hence of similar color; external sepals of cleistogamous flowers usually 1 mm. long or longer; extreme s. Tex. and in Mexico and Guatemala.
 18. *H. glomeratum*.
37. Leaves neither canescent nor equally pubescent on both surfaces and usually of dissimilar color; external sepals of the cleistogamous

flowers usually less than 1 mm. long (or longer in *H. Bicknellii*); U.S. and Canada e. of the Rocky Mts.

38. Cleistogamous flowers few in number and not sharply differentiated from the chasmogamous, borne solitary or rarely two together at ends of branchlets; plants diffusely branched, 1-2(-3) dm. high; e. Mass. s. to Long Island, N.Y. 2. *H. dumosum*.

38. Cleistogamous flowers typically numerous and sharply differentiated from the chasmogamous, often borne in axillary glomerules; plants erect, mostly 2-5 (-6.5) dm. high; e. N. Am.

39. External sepals of the cleistogamous flowers 0.6 mm. long or more; capsule sharply triangular in cross-section
..... 7. *H. Bicknellii*.

39. External sepals of the cleistogamous flowers less than 0.6 mm. long; capsules weakly 3-angled or rounded in cross-section.

40. Stems arising from a horizontal rootstock, mostly less than 3 dm. tall; seeds 1-2(-3) per cleistogamous capsule; cleistogamous flowers few-numerous in each cluster 8. *H. propinquum*.

40. Stems arising from an erect caudex, mostly more than 2.5 dm. tall; seeds 5 or more/cleistogamous capsule; cleistogamous flowers one-few in each cluster
..... 3. *H. canadense*.

1. *Helianthemum carolinianum* (Walt.) Michx.

Cistus carolinianus Walt., Fl. Car. 152. 1788. Walter's Herb. (BM),
Photo: (GH!). Probably from eastern S. Carolina.

- Helianthemum carolinianum* (Walt.) Michx., Fl. Bor.-Am. 1: 307. 1803.
Crocanthemum carolinianum (Walt.) Spach, Ann. Sci. Nat. 2nd ser. 6: 370. 1836.
Halimium carolinianum (Walt.) Gross., Pflanzenreich 14 (IV. 193): 44. 1903.
Heteromeris caroliniana (Walt.) Ponzio, Nuovo Gior. Bot. Ital. n.s. 28: 171. 1921. (No basionym.)

Perennial herb (4)10-30(38) cm. tall with one to several stems arising from a caudex or rarely from subterranean rootstock. **STEMS** ascending to erect, covered with spreading, white, stellate pubescence up to 2.5 mm. long. **BASAL LEAVES** in a rosette; blade (3)10-35(60) mm. long, (3)5-18(28) mm. wide, otherwise similar to the cauline leaves. **CAULINE LEAVES** few and remote; petiole 1-4 mm. long; blade (8)18-36(55) mm. long, (3)5-16(26) mm. wide, spatulate to obovate to elliptic or even elliptic-lanceolate near the apex, green on both sides but turning brown upon drying, sparsely pubescent above (the trichomes up to 1 mm. long), sparsely and more shortly stellate-pubescent beneath; midvein and secondary veins prominent beneath; base of blade attenuate to cuneate, apex obtuse to acute; margin sub-denticulate, non-revolute. Inflorescence: a few-flowered, scorpioid cyme. Flowers mostly isomorphic (chasmogamous), very rarely dimorphic (chasmogamous and cleistogamous); the cleistogamous flowers, when present, one or two near the apex; bracts 2.5-6 mm. long, 0.5-1 mm. wide, lanceolate. Pedicel and calyx covered with spreading, white, pilose or 2-several-branched stellate pubescence (up to 1.5 mm. long) resembling the pubescence of the stem but often less-branched.

CHASMOGAMOUS FLOWERS: pedicels 4-15(24) mm. long, slender, ascending or sometimes curving upwards. **OUTER SEPALS** (free portion) (2.5)4-5.5(7.5) mm. long, (0.4)0.8-1.2(1.5) mm. wide, lanceolate, acute; **INNER SEPALS** (6)7.5-12(14) mm. long, (3)4-5.5(6.3) mm. wide, ovate, acuminate. **COROLLA** yellow, petals 8-18 mm. long, 8-16 mm. wide, broadly spatulate. **STAMENS** 20-35(50). **PISTIL** 1.9-2.7 mm. long; ovary 1.5-2.3 mm. long, 1.3-2.2 mm. in diameter, ovoid, glabrous; style 0.1-0.4 mm. long; stigma c. 1 mm. wide, capitate, papillate. **FRUITING PEDICELS** up to 28 mm. long; fruiting calyx 8.5-12(16.5) mm. long, 6-9 (11) mm. in diameter. **OUTER SEPALS** (free portion) 4-7(9) mm. long, lanceolate, up to 28 mm. long; fruiting calyx 8.5-12(16.5) mm. long, 6-9(11) mm. acute; **INNER SEPALS** 8.5-12(16.5) mm. long, 1.5-3-times longer than the outer sepals, 5.4-7.5(9) mm. wide, ovate, acuminate. **CAPSULE** 6-9 (10.5) mm. long, 4.5-9(10) mm. in diameter, ovoid, glabrous, 3-valved (very few capsules having 4 or even 5 valves); each valve 3.8-7 mm. wide, ovate, acute to subacute. **SEEDS** 80-92(135), ovoid, reddish to dark brown, papillate.

CLEISTOGAMOUS FLOWERS: lacking in about 99 per cent of the specimens examined; when present, pedicels 0.4-3.8 mm. long. **OUTER**

SEPALS (free portion) 1.6-2.8 mm. long, lanceolate; INNER SEPALS 3-4.5 mm. long, c. 1.6 mm. wide. STAMENS 4-6. PISTIL c. 1.5 mm. long; ovary c. 1.2 mm. long, c. 0.7 mm. in diameter, style c. 0.2 mm. long; stigma c. 0.4 mm. wide. CLEISTOGAMOUS FRUITS not seen.

FLOWERING: March-May. HABITAT: dry pine barrens, sandy open woodlands and fields. DISTRIBUTION: along the Coastal Plain from southeastern North Carolina into central Florida and westward into eastern Texas and southern Arkansas. (Map 1.)

Grosser (Pflanzenreich 14 (IV. 193) : 45. 1903.) first described this species as possessing both chasmogamous and cleistogamous flowers. He was followed by Barnhart (in Small, Man. SE. Fl. 879. 1933.) who described it as having "petaliferous flowers with 25-35 stamens and 80 ovules, the apetalous with 5 stamens and 50-60 ovules." Usually this species has only chasmogamous flowers. However, a score or so specimens from Florida amounting to less than 1 per cent of the collections examined had one or two cleistogamous flowers borne near the apex late in the growing season. No cleistogamous fruits were observed.

Spach (Ann. Sci. Nat. 2nd ser. 6: 370. 1836.) included *H. carolinianum* and *H. brasiliense* in his generic segregate, *Crocanthemum*. The basic criterion for this segregation was that both species have only petaliferous flowers. However, *H. carolinianum* very rarely has cleistogamous flowers while *H. brasiliense* typically has them. Therefore the basic characteristic employed by Spach to justify this segregation fails to hold. In addition, the two species do not form a particularly closely related group. For example, the seeds of *H. carolinianum* are papillate and without a separable membrane, while the seeds of *H. brasiliense* are smooth and possess a separable membrane.

REPRESENTATIVE SPECIMENS: NORTH CAROLINA: Robeson Co., 1.7 mi. n. of Lumberton, *Ahles 23716* (DUKE, NCU); Wilson Co., 1.4 mi. sw. of Black Creek, *Radford 35719* (DUKE, NCU). SOUTH CAROLINA: Hampton Co., 3.1 mi. nw. of Yemassee, *Ahles 12432* (DUKE, UNC); Horry Co., 2 mi. s. of Myrtle Beach, *Weatherby & Griscom 16585* (GH, NY). GEORGIA: Screven Co., about 1 mi. n. of Sylvania, *Harper 2081* (GH, MO, NY, US); Sumter Co., 1.5 mi. se. of Flintside, *Moore & Lawrence 671* (GA, SMU, UC). FLORIDA: Alachua Co., *Curtiss 225* (CU, F, KANU, NY, PH, UARK, US); Clay Co., Hibernia, March 1869, *Canby*

(F, MO, NY, PH, US); Duval Co., near Jacksonville, *Curtiss 5830* (FLAS, GH, ILL, ISC, MIN, NCU, NY, SMU, UC, US). ALABAMA: Covington Co., 13 mi. sw. of Andalusia, *Duncan & Hardin 14970* (GA); Mobile Co.: Mobile, *Benke 3370* (F). MISSISSIPPI: Harrison Co., Biloxi, *Tracy 5142* (IND, MIN, MSC, NY, OS); Wayne Co., 5 mi. s. of Buskatunna, *Shinners 27096* (SMU). ARKANSAS: Hot Springs Co., near Malvern, *Palmer 29689* (MO, UARK); Ouachita Co., Camden, *Demaree 16783* (SMU). LOUISIANA: Natchitoches Par., Natchitoches, *Palmer 7703* (NY, MO, US); Rapides Par., vicinity of Alexandria, *Ball 614* (GH, MO, NY, US); Vernon Par., 1 mi. s. of Mayo, *McVaugh & Harvill 8474* (GH, MICH). TEXAS: Harris Co., near Lindale n. of Houston, *Tharp & Barkley 171006* (COLO, CU, DUKE, FLAS, GH, ILL, ISC, MIN, OKL, PENN, TEX, US); Jasper Co., 3 mi. ne. of Evadale, *Cory 52727* (GH, SMU).

2. *Helianthemum dumosum* (Bickn.) Fern.

Crocanthemum dumosum Bickn., Bull. Torrey Club. **40**: 613. 1913.

Type: *Bicknell*, 21 Sept. 1899 (NY!). Nantucket Island, Massachusetts.

Helianthemum dumosum (Bickn.) Fern., *Rhodora* **19**: 60. 1917.

Cespitose, perennial herb, (5)10-20(30) cm. tall, arising from a multicipital caudex. STEMS numerous, forming loosely ascending to depressed mounds, the pubescence pale and stellate, sometimes intermixed with minute, red, glandular hairs; unbranched at first flowering but soon becoming much branched with stiffly divergent to ascending branches. CAULINE LEAVES: petiole 1-2 mm. long; blade (7)12-17(26) mm. long, (2)3-5(10) mm. wide, elliptic to rarely oblanceolate; the blade's upper surface yellowish-green and densely stellate-pubescent but also sparsely intermixed (especially when young) with simple pilose hairs (0.5-1.0 mm. long) and occasionally with minute, red, glandular hairs; lower surface hoary stellate-tomentose; midvein and secondary veins prominent beneath; base of blade cuneate, apex acute; margin entire, mostly non-revolute. FLOWERS: dimorphic (chasmogamous and cleistogamous); maturing at different times during the growing season and at different positions on the plant. At first anthesis with terminal or subterminal, solitary (but sometimes at first appearing paired) chasmogamous flowers (but subsequent development leaving it in the angle of the bifurcated stem, or in the axil of the branch when one of the two branches fails to develop); mostly succeeded by few chasmogamous flowers intermediate in size of calyx and number of stamens between the early ones and the late cleistogamous flowers. Pedicel and calyx of the chasmogamous flowers stellate-pubescent intermixed with apparently simple, pilose trichomes (1.0-1.5 mm. long) and with minute, red glandular hairs. Cleistogamous flowers solitary (rarely two) at tips and forks of the leafy branchlets. Pedicels and calyces of cleistogamous flowers covered with stellate pubescence and simple pilose hairs (c. 1 mm. long) intermixed with red, glandular hairs.

CHASMOGAMOUS FLOWERS: pedicels 2.4-6.0 mm. long, mostly shorter than the calyx. OUTER SEPALS (free portion) 2-6 mm. long, 0.8-3.0 mm. wide, lanceolate to narrowly triangular, acuminate to acute, varying in extent of fusion with the edge of inner sepals from near the base to the middle of the inner sepals; INNER SEPALS 7-10 mm. long, 4.0-6.5 mm. wide, ovate, acute to acuminate. PETALS 5-15 mm. long, 3.6-13.0 mm. wide, yellow, obovate. STAMENS 12-36. PISTIL 2.4-3.5 mm. long; ovary 1.8-2.4 mm. long, 1.4-1.8 mm. in diameter, ovoid, glabrous; style 0.6-1.0 mm. long; stigma 1.2-2.0 mm. wide, capitate. FRUITING PEDICELS 3-9 mm. long. FRUITING CALYX 7-11 mm. long, 3.5-6.0 mm. in diameter, ovoid. OUTER SEPALS (free portion) 2.4-7.2 mm. long, 0.8-3.0 mm. wide; INNER SEPALS 7-11 mm. long, 4.0-6.5 mm. wide. CAPSULE 4-7 mm. long, 2.5-4.0 mm. in diameter, ovoid, glabrous, 3-valved, each 2.2-3.8 mm. wide, ovate, acute. SEEDS 16-53, ovoid to inequilateral, dark brown, papillate, without separable membrane.

CLEISTOGAMOUS FLOWERS: very few on the plant and formed late in the growing season, solitary (or rarely two), sessile. FRUITING PEDICEL 1-3 mm. long. OUTER SEPALS (free portion) 0.4-1.2 mm. long, 0.3-0.6 mm. wide, rudimentary and knob-like to triangular and acute; INNER SEPALS 3-6 mm. long, 2.4-3.2 mm. wide, ovate, acute. STAMENS 5(8). CAPSULE 3.2-4.5 mm. long, 2.4-3.2 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 2.4-3.2 mm. wide, ovate-elliptic, acute. SEEDS 8-14, similar to the seeds of the chasmogamous flowers.

FLOWERING: chasmogamous flowers late May-June, cleistogamous flowers July-September. HABITAT: dry sandy barrens and open woods. DISTRIBUTION: eastern Massachusetts southward to Long Island, New York. (Map 9).

Helianthemum dumosum is very limited in distribution and consequently relatively little collected. It is apparently closely related to *H. canadense* and is often confused with it. The similarity and the differences between the two species are presented in the discussion of *H. canadense*. In addition, *H. dumosum* has leaves often smaller and more crowded on the divergent to ascending branches and branchlets and its chasmogamous outer sepals are relatively broader. According to Bicknell (Bull. Torrey Club 40: 614. 1913.), it blooms earlier than *H. canadense* when both are growing in the same locality.

Usually, *H. dumosum* may be clearly distinguished by the above mentioned characters and those indicated under *H. canadense*. However, it is sometimes difficult to refer a specimen to one species or the other, especially if it was

collected in the middle of the growing season when *H. dumosum* becomes somewhat more erect and approaches *H. canadense* in habit. A few perplexing specimens have been collected on Long Island. The temptation to treat *H. dumosum* as a subspecific variant of *H. canadense* was deemed unwarranted largely because the two when growing together, as they often do within the limited range of *H. dumosum*, maintain their distinguishing features, which implies some sort of effective isolating mechanism. Bicknell (Bull. Torrey Club 40: 614. 1913.) in his original description of this species concluded that "*C. dumosum* is evidently a strongly established derivative of *C. canadense* even if it be not yet wholly disconnected from that species."

REPRESENTATIVE SPECIMENS: MASSACHUSETTS: Barnstable Co.: Harwich, *Fernald 383* (DS, DUKE, F, GA, IA, IND, ISC, KANS, MICH, MIN, MO, NCSC, NO, NY, OKL, PENN, PH, SMU, TENN, TEX, UARK, UC, UMO, US, WIS, WVA); Bristol Co.: Nonquitt, 6 June 1889, *Sturtevant* (MIN); Dukes Co.: near Terry's Pond, West Tisbury, *Seymour 1278* (DUKE, GH, NY, US); e. end of Island, Nashawena, *Fogg 3557* (MIN, PENN); Middlesex Co.: southerly slopes of Arlington Heights, *Fernald, Long & St. John 9945* (PH); Nantucket Co.: Nantucket Island, *Bicknell 5893* (NY, PH); Plymouth Co.: e. of Plymouth, Cape Cod, *Schuster A-3964* (DUKE). RHODE ISLAND: Newport Co.: Grace Point, Block Island, *Fernald, Long & Torrey 9941* (GH, ILL, PH). CONNECTICUT: New London Co.: Groton, 14 July 1929, *Janssan* (ISC). NEW YORK: Suffolk Co.: Montauk, Long Island, *Ferguson 1* (NY); Nassau Co.: Hempstead Plains, Long Island, 30 May 1906, *Bicknell* (GH, NY).

(TO BE CONTINUED)